

**Committee on Science
U.S. House of Representatives
Hearing Charter**

U.S. Vision for Space Exploration

**Thursday, February 12, 2004
10:00 a.m.
2318 Rayburn House Office Building**

1. Purpose

On Thursday, February 12th at 10:00 a.m., the Science Committee will hold a full committee hearing on the President's proposed space exploration initiative, which was announced Jan. 14. (A copy of the White House document that outlines the President's vision is attached as Appendix A.)

2. The President's Proposal

The President's plan can be seen as having three distinct, but related aspects. The first aspect concerns current human space flight programs. The President proposes to complete construction of the International Space Station (ISS) by the end of the decade and to retire the Space Shuttle at that point. ISS research is to be reconfigured to focus on questions related to the impact on human health of spending long periods in space. Under the proposal, the U.S. participation in ISS is slated to end around 2016, although the Administration has said that that date may shift. The National Aeronautics and Space Administration (NASA) has also decided to cancel the Shuttle mission that was needed to keep the Hubble Space Telescope in operation past 2007. Ending the Shuttle and Station programs is necessary to free up funds for other aspects of the proposal and to avoid Shuttle recertification in 2010, an expensive process called for by the Columbia Accident Investigation Board.

The second aspect of the plan concerns new medium-term goals for human space flight. The central goal is to return to the moon between 2015 and 2020. To do this, NASA will develop a new Crew Exploration Vehicle (CEV), which will carry humans by 2014. (The CEV may also be used to service the Space Station.)

The third aspect of the plan concerns long-range goals for the years past 2020. The entire plan is geared toward preparing for this period, but what will happen during these years is (perhaps necessarily) left entirely open-ended. The ultimate goals are to send humans to Mars and "worlds beyond" and to increase the commercial exploitation of space. The timing of future exploration is left open and will depend on the pace of technology development and discovery during the years leading up to 2020. The President announced the appointment of a nine-member commission, headed by former Secretary of the Air Force Pete Aldridge, that will focus primarily on recommending what kinds of things ought to be done in the long-run on the moon and to get to Mars, and how those activities might shape programs in the nearer term.

3. Overarching Questions

The President's plan raises many fundamental questions about the purposes of the U.S. space program and about the details of how it will be carried out. The overarching questions for the hearing include:

1. What is the **purpose** of the exploration program? To what degree will it be designed to answer scientific research questions? To what degree will it be designed to promote commercialization or national security interests? How high a national priority is exploration for exploration's sake?
2. How much will the President's proposal **cost** to implement now and in the future? What are the greatest uncertainties in the budget estimates that have been presented? When will those figures become more definite? Are there early points at which progress can reasonably be assessed? What is being done to avoid the inaccurate cost estimates that have plagued the Space Shuttle, Space Station and Orbital Space Plane programs?
3. What **budgetary tradeoffs** will have to be made to fund the President's proposal? Specifically, what will the impact be on NASA's programs in astronomy, outer planetary exploration, earth science, and aeronautics?

The overall goal of the hearing is to make sure the Committee has clear information on the philosophy and budgetary assumptions that undergird the President's proposal.

4. Witnesses

Mr. Sean O'Keefe, Administrator of the National Aeronautics and Space Administration.

Dr. John Marburger, Director of the Office of Science and Technology Policy.

5. Issues

- **What is the goal of the President's initiative?** Human space travel is inherently expensive and risky compared to robotic missions. Congress needs to decide whether human space travel is a priority that merits continued funding, and obviously that will depend, in part, on what is to be gained. In his Jan. 14 speech, the President said, "We choose to explore space because doing so improves our lives and lifts our national spirit." But the Administration has sent mixed signals about what kinds of improvements will be sought. In some presentations, the Administration has left the impression that exploration is a basic human need, an end in itself – an activity that will be informed by science and may contribute to science, but that will not have a science-driven agenda. In other presentations, the Administration has implied that science is the primary rationale for the President's vision. In other places, commercialization, national security, and the possibility of technological spinoffs have been offered as rationales. None of these reasons is mutually exclusive, but the goals of the program will determine the spending and activities that are undertaken.

- **How much will the President's initiative cost?** The President has been clear that he is not willing to seek massive amounts of new spending to fund the initiative – unlike the approach that was taken during the Apollo program in the 1960s. NASA officials have said that if work does not proceed smoothly, they will extend deadlines rather than increase annual costs. (Moving deadlines would still increase cumulative costs.) The President has proposed a 5.6 percent increase for NASA (to \$16.2 billion) for Fiscal Year (FY) 05, by far the largest increase for any R&D agency.

Figuring out how much the President's initiative would cost is not easy because of the many assumptions that need to be made. Adding to the complexity, NASA has described the costs differently in different documents, using different baselines.

The most specific figures concern the next five years (FY 05-09), over which the President proposes to spend a cumulative total of \$87.1 billion on the entire NASA budget. NASA has compared the proposal to two different baselines. In the first comparison, NASA says that over the next five years, the President proposes to spend \$1 billion more on the entire NASA budget than NASA had predicted it would spend in February, 2003. (That estimate was made as part of the Presidents's FY 04 budget.) In the second comparison, NASA describes the President's proposal as providing \$12.6 billion more, cumulatively, over five years for the entire NASA budget compared to what NASA would have received if its spending had been frozen for five years at the FY 04 level of about \$15 billion. (NASA uses this figure frequently, but there is no evidence that NASA was ever going to face such a freeze.)

Figuring out how much of the NASA budget will be dedicated to the President's initiative depends on what is included in that spending category. Should it include the Space Shuttle and Space Station? Should it include robotic missions that were planned before the President's announcement, but may contribute to it, or just new ones? NASA, generally, includes all robotic missions that will contribute to the initiative and excludes the Space Shuttle and Space Station. Using those definitions, the initiative would receive \$31.4 billion over the next five years. Costs would increase considerably in the subsequent 10 years, and costs cannot even be estimated for the period beyond that because the activities remain undefined. (See attachment B, although, according to NASA, the chart was designed more for internal purposes than to give a precise picture of out-year spending.)

- **What are the greatest uncertainties in NASA's cost projections?** Of necessity, the proposed budget is based on best guesses of costs for key elements of the President's initiative.

Perhaps the greatest uncertainty remains the cost of continuing to operate the Space Shuttle. Any delay in retiring the Space Shuttle will add significantly to NASA's costs (as well as raising the question of whether the Shuttle should fly without recertification). NASA continues to assume a return to flight this fall, although experts inside and outside the agency are raising doubts about whether that deadline can be met. Once flights resume, NASA plans about five flights a year – a pace that Admiral Gehman, the chair of the Columbia Accident Investigation Board, has said could revive concerns about “schedule pressure” adversely affecting safety. Retiring the Shuttle on schedule may also require using means other than the Shuttle to take up crew and supplies to the Space Station because the Shuttle will be needed to complete Station construction. Shuttle retirement could also be delayed if key portions of the Station, such as the centrifuge

being built by the Japanese, are not completed on schedule. (The centrifuge is generally viewed as the most valuable piece of scientific equipment that will be brought to the Station.) NASA is still figuring out the “manifests” for the remaining Shuttle flights – that is, the description of when flights would leave and return and what they would carry.

The costs of developing the CEV, the new vehicle that would take astronauts to the moon and beyond also are uncertain because development has not yet begun. In some ways, CEV development will build on the Orbital Space Plane (OSP) project that NASA discontinued as part of the President’s initiative. The OSP, which was to be designed primarily to take astronauts to the Space Station, was already facing cost overruns in its early design stages, and Congress was raising doubts about its usefulness. NASA now estimates that it will spend \$6.5 billion over the next five years on CEV development.

The CEV may also require the development of a new launch system, and NASA has not decided yet how to approach the design of a new launch vehicle. The Office of Management and Budget is now estimating that the development of such a vehicle will cost about \$5 billion. If an existing launch vehicle were used, it presumably would require modifications to support a human launch (“man rating” the vehicle).

Administration officials have said that because the CEV and its launch system will be developed over a longer time period than was allotted for the OSP there will be time to reevaluate costs before becoming overly committed to a particular design. Total CEV development is expected to cost about \$15 billion (excluding any costs for a launch vehicle).

The cost of the CEV may be affected by how NASA decides to select a contractor for the program. NASA limited OSP development to two competitors. NASA has not yet made clear whether it will have a more open competition for the CEV.

- **How will the President’s initiative affect the rest of NASA’s programs?** The Space Sciences budget will continue to grow (from \$3.9 billion in FY 04 to \$5.6 billion in FY 09) because many of its robotic missions will be considered part of preparation for human exploration. Most of these missions will be entirely unchanged despite the redesignation. In addition, new lunar missions will be added. Nonetheless, projects totaling about \$2.6 billion will be cut from the Space Sciences budget over the next five years (compared to the Administration’s February, 2003 projections) by canceling or deferring missions and programs that are considered less important to human exploration. (Other projects are added so that, overall, Space Sciences will receive slightly more over the five-year period than had been planned, if one excludes Project Prometheus, which is being transferred from Space Sciences to another account.) One question is how Space Sciences will fare in the years after FY 09 when the costs of a human lunar landing will begin to increase substantially.

Earth Science would fare far worse, sustaining cuts in FY 05 through FY 08. Earth Science spending would decline from \$1.52 billion in FY 04 to \$1.47 billion in FY 09, a year in which it is slated to receive an increase. NASA Earth Science missions are a major component of the Administration’s climate change science program.

Aeronautics would be essentially flat through the period, increasing in some years and decreasing in others, but ending up in FY 09 at \$942 million – a drop from the FY 04 level of \$946 million.

(See Attachment C for more details.)

- **Why is the Shuttle mission to the Hubble Space Telescope being cancelled?** The Administration is describing the Hubble cancellation as a “close call” made by the Administrator because of safety concerns. The Hubble, which has been enormously successful, is expected to stop working around 2007 without a servicing mission. Many astronomers are lobbying for that mission to occur, and, indeed, before the President’s initiative was announced, a panel assembled by the National Academy of Sciences, called for another servicing mission to be added to extend the telescope’s life even further. That request became moot with the decision to discontinue the Shuttle in 2010. However, some experts contend that ground-based optical telescopes have advanced so much in recent years that they can now make up for at least some of the capability that would be lost if the Hubble ceases to function.

A Shuttle mission to the Hubble is a special case because a Shuttle on a Hubble mission cannot reach the Space Station, which could be used as a “safe haven” in case of an emergency or the need to inspect or repair the Shuttle. The Columbia Accident Investigation Board said that the Shuttle should fly to destinations other than the Space Station only when NASA had developed an “autonomous” inspection and repair capability – that is, a way to inspect without using the Space Station. NASA believes such a capability is probably many years away. As a substitute, NASA examined having a second Shuttle ready to fly a rescue mission, but viewed that as dangerous and prohibitively expensive. However, debate continues among Hubble enthusiasts as to the relative dangers of a mission to the Station and a mission to Hubble.

NASA acknowledges that there were “secondary” considerations that also led to the cancellation of the Hubble mission, including the need to complete all the Shuttle missions needed for Station construction by 2010.

- **How will the President’s initiative change the Space Station program?** As a result of the initiative, NASA is reexamining the entire Station research program. Decisions on the new program may not be made for about a year. The new program will focus on questions of astronaut health. Among the questions this raises are: what research will be discontinued and was any of it of real value? How much will the new research agenda cost? Does the new research really require facilities in space and will it be peer reviewed? Will concerns arise since much of the new research will presumably involve using astronauts as human experimental subjects?
- **How will NASA transport crews to the Station after the Shuttle is retired?** The Administration acknowledges that it has not yet figured out how to get crews to the Station between the retirement of the Shuttle in 2010 and the first flight of the CEV in 2014. (The Shuttle may also be unavailable for crew transfer earlier, if its schedule needs to be devoted entirely to Station construction.)

The U.S. is already using the Russian Soyuz spacecraft for crew transfer while the Shuttle is grounded. However, it is doing so under an agreement that the Russians will have fulfilled by 2006. Renegotiating the agreement may require a change in the Iran Nonproliferation Act (INA), which Congress passed in 2000. That Act attempts to prevent the spread of weapons of mass destruction to Iran by prohibiting the purchase of Russian rockets by the U.S. unless the President certifies that no Russian entity is

engaged in any sales of missiles or missile systems to Iran. (The INA does not apply to the current agreement.)

Amending the Act would be controversial, and so far the Administration has hedged its bets, simply saying that the matter is under review.

- **How will NASA carry cargo to and from the Station after the Shuttle is retired?**
Similar to the crew situation, NASA has no current plan for getting cargo to the Station after the Shuttle is retired. NASA is using Russian Progress vehicles while the Shuttle is grounded, but continuing to do so indefinitely could require amending the Iran Nonproliferation Act. (See above.) NASA might also rely on Europe or Japan, which are partners in the Space Station and which are developing cargo-carrying spacecraft of their own. But those craft have not yet been flight-tested. Some have suggested that NASA could convert the space shuttle itself into a cargo-only craft that could deliver huge loads of cargo to the ISS. But critics have said that such an approach would be much more expensive than flying smaller loads on existing rockets. Finally, NASA might try to purchase the services of commercial rocket firms. But at present no firm has a rocket that can supply the Station, although several have indicated a willingness to try to carry small amounts of cargo there. Another complication is that some cargo for the Space Station is very large – major replacement parts, for example – and most craft other than the Shuttle are not big enough to carry such cargo. Another serious complication is that none of the existing or currently planned alternatives to the Shuttle can bring cargo back from the Station. Such cargo could include the results of scientific experiments, air quality and other monitors, and Station equipment in need of repair.

6. Questions to witnesses:

In his letter of invitation to appear as a witness, Administrator O’Keefe was asked to address the following questions in his testimony:

- (1) What specific activities must be undertaken and milestones achieved over the next twelve months and over the next five years to implement the new initiative? What analysis was performed to ensure that the proposed budget is adequate to accomplish those activities?
- (2) Specifically, what changes (in spending and program content) are contemplated in the Shuttle, International Space Station, and Space Science programs as a result of the new initiative?
- (3) What is the current status of NASA’s thinking about a mission to the Hubble Space Telescope? What changes in spending and in other NASA activities would be necessary to allow one or two more missions to the Hubble?
- (4) Are any changes to the Iran Non-proliferation Act, the Space Station Inter-Governmental Agreement or any other agreements required to complete the Space Station? If so, please explain how the Administration plans to inform and consult with the Congress on these changes, including the timetable for any actions that may be necessary.

In his letter of invitation to appear as a witness, Dr. Marburger was given the following information and asked to address the following questions in his testimony:

In their briefings on the initiative, White House officials have said that you were an active participant in developing the initiative, and that, more specifically, you had

reviewed the initiative to ensure that no essential science activities would be sacrificed to pay for it.

In your testimony, you should describe the role you and your staff played in formulating the initiative and why and how you concluded that the initiative would be a net benefit from a scientific point of view. As part of that description, please specifically address the following:

- (1) What criteria did you use to determine whether an activity was “essential,” and how did you evaluate and balance the differing scientific benefits of existing and potential NASA activities?
- (2) To what extent, has and can the International Space Station contribute to science? Did you review any specific new research agenda for the Space Station as part of your evaluation of the overall initiative?
- (3) To what extent can scientific research that would be accomplished by manned missions to the moon be accomplished by space telescopes or by unmanned probes on the moon?
- (4) How would you describe the contributions to science made by the Hubble Space Telescope? How would you assess what would be lost if the Hubble ceases to function earlier than had been planned? How did you weigh those losses against the potential benefits of other activities under the new initiative?”

7. Attachments

Attachment A: A Renewed Spirit of Discovery: The President’s Vision for U.S. Space Exploration

Attachment B: NASA Budget Projection 2004-2020. (This chart can be viewed in color on the Internet at http://www.nasa.gov/pdf/54873main_budget_chart_14jan04.pdf)

Attachment C: NASA FY2005 Budget